

WHAT IS CLAIMED IS:

1. A method for polishing side faces of grooves formed on a workpiece comprising the steps of:

cutting the grooves on the workpiece with a cutting blade;

inserting a polishing element into one of the grooves, the width of the polishing element being smaller than that of the groove, by vertically moving at least one of the workpiece and the polishing element;

contacting a side face of the groove with a main surface of the polishing element by horizontally moving at least one of the workpiece and the polishing element; and

polishing the side face of the groove by relative movement between the work and the polishing element by sliding the polishing element along the groove by moving at least one of the workpiece and the polishing element and by urging the main surface of the polishing element toward the side face of the groove.

2. The method according to claim 1,

wherein, in the contacting step, a predetermined contact position of the polishing element to the workpiece is detected by measuring the load on the polishing element, and

in the polishing step, the moving conditions of at least one of the workpiece and the polishing element are determined using the predetermined contact position of the polishing element to the workpiece as a reference, so that polishing is performed over a predetermined distance.

3. The method according to claim 1, wherein, in the polishing step, the polishing element is moved vertically.

4. The method according to claim 1, wherein, in the polishing step, the polishing element is moved horizontally.

5. The method according to claim 1, wherein, in the polishing step, the polishing element is reciprocated with respect to said workpiece.

6. The method according to claim 1, wherein said cutting step and said polishing step are carried out with a single element which serves both as the cutting blade and the polishing element.

7. The method according to claim 1, wherein said cutting blade and said polishing element are disposed separately on a rotating shaft and at least one of said rotating shaft and said workpiece is displaced between said cutting step and said polishing step.

8. The method according to claim 1, wherein said groove extends fully through said workpiece.

9. The method according to claim 1, wherein said groove extends partially through said workpiece.

10. The method according to claim 2, wherein the load on the polishing element is measured by detecting an electrical characteristic of a driving unit of said polishing element, said electrical characteristic comprising at least one of a magnetic field and a current of said driving unit.

11. The method according to claim 2, wherein said workpiece is a semiconductor wafer and said polishing step gives said side face a surface roughness R_a of about 10 nm or less.

12. The method according to claim 11, wherein after polishing, said side face has chipping of about 100nm or less.

13. A method for polishing side faces of grooves formed on a workpiece, comprising the steps of: inserting a polishing element into one of the grooves, the width of the polishing element being smaller than that of the groove, by vertically moving at least one of the workpiece and the polishing element;

contacting a side face of the groove with a main surface of the polishing element by horizontally moving at least one of the workpiece and the polishing element; and

polishing the side face of the groove by relative movement between the work and the polishing element by sliding the polishing element along the groove by moving at least one of the workpiece and the polishing element and by urging the main surface of the polishing element toward the side face of the groove.

14. The method according to claim 13,

wherein, in the contacting step, a predetermined contact position of the polishing element to the workpiece is detected by measuring the load on the polishing element, and

in the polishing step, the moving conditions of at least one of the workpiece and the polishing element are determined using the predetermined contact position of the polishing element to the workpiece as a reference, so that polishing is performed over a predetermined distance.

15. An apparatus for polishing side faces of grooves formed on a workpiece comprising:

a fixture for fixing the workpiece;

a rotating shaft disposed in a horizontal direction of the fixture;

a rotary driving unit for rotating the rotating shaft;

a disc polishing element having abrasive grains thereon for polishing the side faces of the grooves, the polishing element being fixed to the rotating shaft;

a driving unit for driving at least one of the rotating shaft and the workpiece in the vertical direction of the rotating shaft, in the horizontal direction of the rotating shaft, and in the direction along the side face of the grooves; and
a detector for detecting the position where the polishing element is in contact with the workpiece.

16. An apparatus according to claim 15, wherein said abrasive grains on said disk polishing element have a cutting depth of about 10nm or less.

17. An apparatus according to claim 15, wherein said disk polishing element has said abrasive grains on a side face thereof for polishing said workpiece, and said disk polishing element further comprises abrasive grains at a peripheral edge thereof for cutting said workpiece.

18. An apparatus according to claim 15, further comprising a sensor for detecting said contact position by detecting an electrical characteristic of said rotary driving unit, said electrical characteristic comprising at least one of a magnetic field and a current of said rotary driving unit.

19. An apparatus according to claim 18, wherein said sensor is a Hall sensor.

20. An apparatus according to claim 15, wherein said driving unit drives said at least one of the rotating shaft and the workpiece using said detected contact position as a reference.